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OCCURRENCE OF CURLY TOP IN THE PACIFIC NORTHWEST IN 1934

B. F. Dana

The 1934 season has witnessed the most extensive occurrence of curly top on record for the Pacific Northwest and the most serious ephiphytotic of the disease since 1926.

The winter of 1933-34 was exceptionally mild, favorable both for the beet leaf-hopper vector of curly top and the hosts upon which it feeds during the winter. The open winter was followed by an early spring, providing favorable conditions for early maturity and migration of the vectors.

The severity of the disease indicated a possible increased virulence of the virus carried by the vector due to passage through favorable weed and native hosts. This was in sharp contrast to the 1933 season when the development of the disease indicated a decreased virulence of the virus which could be explained by the scarcity of susceptible host plants. The severe winter of 1932-33 had eliminated most of the hosts upon which the leaf hopper overwinters.

The following observations made by the writer will indicate the distribution and importance of curly top in representative areas visited one or more times during the season.

WESTERN OREGON

Willamette Valley

June 21	Jefferson	Tomato	10 A.*	10% loss
		Squash	garden	trace
		Peppers	4 A.	trace
		Table beets	garden	trace

Adult beet leaf hoppers and nymphs found on beets.

*In many cases acreage given covers more than one field with range of crop loss.

June 21	Salem	Tomato	2 A.	10% loss
		Table beets	1/2 A.	early symptoms
		Adult beet leaf hoppers and nymphs found on beets.		
	Grand Island	Tomato	15 A.	10 - 15% loss
		Table beets	garden	early symptoms
		Adult beet leaf hoppers and nymphs found on beets.		
June 27	Corvallis	Tomato	garden	trace-10%
		Table beets	garden	early symptoms
June 29	Irish Bend	Tomato	garden	trace
		Few adult beet leaf hoppers found on table beets.		
July 2	Brownsville	Tomato	1 A.	20% loss
		Table beets	garden	early symptoms
		Adult beet leaf hoppers and nymphs found on table beets.		
July 3	Eugene	Tomato	2 A.	2% loss
July 6	Milwaukie	Tomato	garden	10% loss
		Table beets	garden	25% loss
		Beans	garden	5% loss
		Pansy*	5 A.	20% severe
		Adult beet leaf hoppers and nymphs abundant on table beets. The two plantings were separated 80 rods or more. The abundance of nymphs among the pansies indicates a favorable host for breeding.		
		*First diagnosed as curly top by F. P. McWhorter.		
	East Portland	Tomato	All gardens	1 - 10% loss
	Columbia Slough	Tomato	1/2 A.	20%
		Table beets	1/2 A.	early symptoms
		Adult beet leaf hoppers and nymphs abundant on beets		
Aug. 23	Springfield	Table beet seed field	1 A.	100% loss
		Table beet spring crop	3 A.	75% loss
		Adult leaf hoppers and nymphs abundant on table beets.		
Aug. 28	Marion	Tomato	1 A.	11% loss
		Cucumber	garden	trace
		Squash	garden	trace
		Cantaloupe	garden	trace

Aug. 28	Salem	Tomato	2 A.	10 - 15% loss
		Table beet	1/2 A.	25% loss
	Grand Island	Table beet	garden	10 - 20% loss
		Mangels	garden	25% infected
		Tomato	10 A.	20%
		Cantaloupe	garden	1% infected
		Squash (Table Queen)	garden	25% loss
		Squash (Hubbard)	garden	75% loss
		Tobacco	garden	1% loss
	Canby	Pansy, seed	16 A.	50% loss
	Portland	Pansy, seed	1 A.	50% loss
Aug. 30	West Stayton	Tomato	5 A.	1% loss
		Table beet	garden	10% infected
		Mangels	garden	10% loss
		Cantaloupe	garden	trace

Southern Oregon

Sept. 7	Medford-Ashland	Tomato	350 A.*	10 - 30% loss*
		Table beets		trace
Sept. 8	Grants Pass	Tomato	25 A.	2% loss

*Estimate by Ashland Cannery Manager which observations of writer would indicate to be conservative.

Oregon Coast

Sept. 8	Coquille	Tomato	1 A.	10 plants
Sept. 26	Cannon Beach Junction	Swiss Chard	garden	trace

Adult beet leaf hoppers found on table beets.

Sept. 29	Pistol River	Tomato	garden	specimen

The spread of curly top in Western Oregon to the extreme coast had not been recorded in previous years. Since the beet leaf hopper is not known to overwinter in Western Oregon the insect must have migrated from breeding grounds east of the Cascade Range. Observations near Brownsville, July 2, and near Springfield, August 22, indicated that leaf hoppers had migrated westward over both the Santiam and McKenzie passes. It is evident also that migrations into the Rogue River Valley must have crossed the Cascade Range at some point further south.

EASTERN OREGON

Bend-Redmond Area

Sept. 5	Redmond	Tomato	garden	100% loss
		Squash (Hubbard)	garden	100% loss
		Sugar beet U.S. #1	1/4 A.	50% loss
		Pansy	garden	100% loss
		Table beets	garden	100% loss
	Prineville	Squash (Hubbard)	garden	100%

The severity of the disease in this area indicates proximity to natural breeding grounds for the hopper vector. The severity of curly top in this area observed in 1932 and 1933 also tends to substantiate this conclusion.

Klamath Falls Area

Sept. 6	Klamath Falls	Squash (Hubbard)		75% loss
		Tomato		trace
	Olene	Squash (Golden Delicious)		trace
		Table beets		trace

Adult beet leaf hoppers and nymphs found on beets.

	Bonanza	Sugar beet	1 A.	50% loss

Adult beet leaf hoppers and nymphs abundant on sugar beets.

Hood River-Dalles Area

July 9	The Dalles	Tomato	20 A.	50 - 75% loss
		Peppers	gardens	10% loss
		Squash (Hubbard)	gardens	100% loss
Aug. 9	The Dalles	Tomato		10 - 90% loss*
		Squash, Vegetable Marrow	garden	75% loss
		Peppers	1/10 A.	20% loss

*Earlier crop suffered heavier loss.

July 29	Hood River	Tomato	gardens	50% loss
		Squash (Hubbard)		50% loss
Sept. 17	Dufur	Tomato	garden	80% loss

Milton-Freewater Area

Aug. 13	Milton-Freewater	Tomato	400 A.	80 - 90% loss

Estimated by local growers and substantiated by observations by writer.

Ontario District

July 25	Ontario	Tomato	garden	100% loss
		Cantaloupe Superfecto	5 A.	general, mild symptoms
		Honey moon melon	garden	very severe injury

Umatilla Project

Sept. 22	Hermiston	Tomato		95% loss
		Squash (Hubbard)		100% loss

CENTRAL WASHINGTON

Pasco Section

July 12	Pasco	Tomato	15 A.	10 - 30% loss
		Peppers	2 A.	20% loss
		Squash (Hubbard)	garden	100% loss
		Cantaloupe, Hale		general occurrence of symptoms
		Cantaloupe, Weabers special	1/4 A.	severe injury
Aug. 13	Pasco	Tomato	District	75-90% loss

Yakima Valley

July 12	Toppenish	Tomato	24 A.	30 - 90% loss
		Peppers	5 A.	10% loss
		Cantaloupe Hale		general occurrence of mild symptoms
July 13	Wapato	Tomato	27 A.	20 - 80% loss
		Peppers	2 A.	25% loss
		Squash, Patty Pan	1/3 A.	75% loss
		Eggplant	1/3 A.	trace
		Sugar beet U.S. #1	5 A.	50% loss
		Sugar beet common	5 A.	75% loss
	Yakima	Tomato	gardens	20% loss

EASTERN WASHINGTON

Clarkston and Adjacent Idaho

Aug. 10	Clarkston	Tomato	garden	25% loss
	Lewiston	Tomato	garden	50 - 90% loss
		Squash (Hubbard)	garden	100% loss
		Cucumber, Ames Hybrid	garden	100% loss
		Cantaloupe, Hale	garden	10% loss
		Perfecto	garden	20% loss
		Sugar Rock	garden	50% loss

Pullman Section

Aug. 11	Pullman	Tomato	garden	10 - 100% loss
		Squash (Hubbard)	garden	100% loss

CURLY TOP OF VEGETABLES IN IDAHO

C. W. Hungerford

The curly top disease on various vegetables was more severe this year than it has ever been since plant disease records have been kept at the Experiment Station. Complete destruction of cucumbers occurred in the Experiment Station plots. In 22 selections and crosses of tomatoes, the amount of infection ranged from 3 per cent to 85 per cent. In 120 Great Northern-x-Robust crosses of beans the infection ranged from 0 to 10 per cent. Curly top disease was very prevalent in the vicinity of Lewiston, Idaho where the altitude is a little over 600 feet. Very serious loss resulted from infection of this disease upon cucumbers. One outfit at Lewiston stated that they were able this year to pick only one-seventh of the expected amount of dill pickles because of the curly top disease. Tomatoes were almost a total loss in the vicinity of Lewiston and cantaloupes and certain varieties of squashes were generally affected throughout the regions of the State where they are grown successfully.

The curly top disease was unusually severe in the Twin Falls area during the 1934 season on commercial plantings of sugar beets and beans, and on certain garden vegetables. Plantings of common commercial sugar beets were 100 per cent loss. The loss on Great Northern field beans varied between 10 per cent and 20 per cent. The production of garden and canning type beans was estimated by contract seedsmen as 60 per cent of normal production. The greater part of this reduction was occasioned by curly top. Losses on tomato and squash plantings were about 75 per cent.

The very mild winter of 1933-34 was undoubtedly responsible for the prevalence throughout the Northwest of the sugar beet leafhopper and the curly top disease which it transmits. The temperatures were such in the hibernating areas of the insects that an unusual number survived which normally perish.

DISEASES OF NUT CROPS IN OREGON AND WASHINGTON

FILBERT: Bacterial blight (Bacterium sp.) is present this season in many filbert plantings in Washington and Oregon. In general, the disease is worse this season than it has been for some years past. Many young trees from two to four years of age have died this year from bacterial blight. Thus, in one orchard near Newberg, Oregon, approximately 10 per cent of the trees have succumbed to this disease. Trees in older plantings ranging from five to fifteen years of age have also been attacked by bacterial blight during the season just past. In older trees, the disease typically caused a death of the smaller twigs in the tops of the trees instead of a girdling of the trunks, as is generally the case in young trees from two to four years of age.

WALNUT: A leaf spot of Juglans regia, which has not heretofore been clearly distinguished from other leaf diseases of the Persian walnut, was very prevalent in Oregon this year, particularly during the latter part of the season. This leaf spot is characterized by the presence of small, circular, opaque, chocolate-brown spots, seldom measuring more than one-sixteenth of an inch in their greatest diameter. The lesions occur primarily in the lamina of the leaf. The name "freckle spot" is proposed to distinguish this leaf spot from other leaf diseases common to the Persian walnut in the Pacific Northwest. Microscopic examination of tissues from typical "freckle spot" lesions have failed thus far to reveal the presence of any parasitic micro-organism. Attempts to isolate a causal pathogene from affected tissues have likewise been attended with negative results. It would appear from studies carried on to date that this leaf spot is due to some physiological disturbance caused by some unfavorable non-parasitic factor or factors, the exact nature of which is not yet definitely known (P. W. Miller, Oct. 9, 1934).

POD BLIGHT OR ANTHRACNOSE OF LIMA BEANS

Lima bean pods from Cuba intercepted by quarantine inspectors at New York City, November 3, were affected with a disease which is evidently the same as the one reported from North Carolina and Virginia by W. D. Moore, and from Georgia by J. H. Miller, in the Plant Disease Reporter, Volume 15, pp. 113 and 114, Sept. 1, 1931. The fungus seems identical with that on specimens from the previous collections which was determined as Vermicularia polytricha Cke. (N. R. Hunt and J. A. Stevenson).

VEGETABLE DISEASES IN MASSACHUSETTS

Reported by O. C. Boyd, Nov. 5.

POTATO: More and more reports are coming in regarding late blight rot of potatoes (Phytophthora infestans). This is particularly true in the Connecticut Valley, and in the hill towns generally where potatoes matured late. In many home gardens and smaller commercial plantings, the losses are exceedingly heavy. On some farms, little or no decay was noticeable at harvest, but rot is now developing in storage. Even many of the more experienced growers are finding traces up to 10 per cent or more of late blight rot at digging or in storage.

CELERY: Survey visits in the Boston market garden section on October 15, revealed that rapid and, in some instances, very severe spread of late blight of celery (Septoria spp.) had occurred during late September and early October. This situation prevailed, however, only when adequate protection had not been given the crops. Both late plantings of white celery and green celery for storage were so affected.

LETTUCE: Fall crops of lettuce in both the eastern and Valley sections underwent marked losses from bottom rot (Rhizoctonia) and drop (Sclerotinia), being favored, no doubt, by the rainy weather of September and October.

SPINACH: Fall spinach crops generally over the State have exhibited worse than usual a yellowing and stunting of the plants quite common at this time of the year. The condition appears to be due to unfavorable growing conditions rather than to any parasitic factors. Only light scattered infections of downy mildew (Peronospora effusa) of spinach have been reported this fall, despite of the apparently favorable conditions for its spread during the past two months.

POD AND STEM BLIGHT OF SOYBEAN IN ILLINOIS

In the middle of September, I had received some specimens of soybeans from the northern part of the State which were rather heavily infected with Diaporthe sojae. At the same time, I also had the opportunity to make observations in the central part of the State and found scattered infections in these fields. Pycnidia of the fungus were fairly easy to find.

The weather during the three weeks preceding that time had been very favorable for this kind of infection. During that time we had frequent rains. This disease is about as dependent on damp weather as is the scab disease of cereals. Since the middle of September, however, the prevailing weather has been fair and sunny, and I doubt whether much additional damage has resulted. I have learned in the past years that this disease may cause very serious injury to germination. (Benj. Koehler, Nov. 8).

ERGOTY RYE

Mr. Robert H. Black, Grain Supervisor, Minneapolis, reported that during the month of August, 1934, 433 cars of rye were received at Minneapolis of which 53 or 12.2 per cent were classed as ergoty. During the month of September, 240 cars were inspected and 51 or 21 per cent were ergoty. According to the new official grain standards of April, 1934, ergoty rye is rye which contains ergot (Claviceps purpurea) in excess of 0.3 per cent.

COVERED SMUT OF BENT GRASS IN OREGON

Dr. Roderick Sprague sent in a specimen of a covered smut on seed of Agrostis maritima which he had determined as Tilletia decipiens (Pers.) Körn. Mr. J. A. Stevenson has confirmed the identification but states that the spores are much less deeply reticulated than they are in typical material. Dr. Sprague's note concerning the specimen follows (Oct. 13):

Mrs. Grace Cole Fleischman of the United States Seed Laboratory at Corvallis noted the discolored seed and referred them to me. Agrostis maritima, seaside bent, is grown in considerable acreage and this smut might become of serious economic importance. Mrs. Fleischman believes that this is the first time she has seen smut in the bent grasses from Oregon.

RUST ON GOAT'S RUE

In a plot of goat's rue (Tephrosia virginiana or Cracca virginiana) cultivated experimentally at Milano, North Carolina, a serious rust infestation was observed by G. A. Russell, who on October 16, 1934, transmitted specimens for identification in care of A. F. Sievers. The fungus was identified as Ravenelia epiphylla (Schw.) Diet. It is known only upon this normally wild plant, but it has a wide distribution throughout most of the range of its host in eastern North America. The parasite may be a factor of economic significance, since the goat's rue is assuming importance as a promising source of rotenone, a possibly valuable insecticide.

Wide differences in inherited resistance or susceptibility to rust infection have been demonstrated for many kinds of plants, and it is to be expected that individual plants of goat's rue will differ likewise. Search for plants of this species free from the disease but adjacent to infection should therefore reveal individuals genetically immune from, or at least resistant to, the disease. Such stock would be especially desirable for breeding and propagation. (William W. Diehl)

BLACKHEART DISEASE OF CELERY

A. C. Foster

In 1932 a questionnaire was sent to the plant pathologists or botanists of experiment stations of this country and Canada, requesting an expression of opinion as to the presence, prevalence, and nature of celery blackheart and the relation of various environmental and soil conditions to its appearance. The response to this questionnaire was so prompt and unanimous it was thought a summary of the information so collected would be of particular interest to those who so kindly collaborated as well as to others. Any additional information concerning this peculiar disease will be greatly appreciated by the writer.

Reports concerning the presence of blackheart have been fragmentary and infrequent in the past. The first account of the disease was that by Kinney of Rhode Island, in 1897. In 1907, Winters, working in Florida, made the first organized attempt to study the disease. He was the first investigator to recognize that the disease was not of parasitic origin. Since 1892 numerous investigators have reported the appearance of a soft rot decay, caused mainly by organisms of the Bacillus carotovorus group, a disease similar in many respects to blackheart. The evidence at hand indicates that apparently the two similar diseases of celery have frequently been confused. Investigators generally recognize Bacillus carotovorus and similar organisms as essentially wound parasites. The suggested probability of organisms of this type being generally secondary to blackheart is a subject for further investigation.

The two diseases are usually easily distinguished. The soft rot disease is of course localized and causes a complete decay of affected parts usually with no possibility of recovery. Blackheart originates deep in the heart leaves, where it causes at first discoloration of the veins and margins. Very often the advance of the disease is only slight and affected parts continue to grow. The same plants may become affected six or eight times and continue to recover and grow away from the disease. In the case of mature plants, which appear to be more susceptible, the entire heart is often affected and recovery is not so usual. Plants affected with blackheart offer ideal conditions for the attraction of insects and the attendant dissemination of organisms of the soft rot type. The work of Leach in Minnesota demonstrates clearly the relation of an insect to the transmission and spread of Bacillus carotovorus and its relation to soft rot.

The questionnaire submitted to the respective State plant pathologist or botanists for reply was as follows:

"According to the available information, the disease has been reported in practically every State in which celery is grown. To have a more complete authentic record of the distribution, prevalence, and conditions favorable to the disease, I will greatly appreciate the favor of having the following questions answered:

"Is celery blackheart disease prevalent in your State?

"Is its appearance associated in any way with deficient or excessive soil moisture?

"Is the disease more prevalent on soils of low water holding capacity, or on well drained muck lands?

"At what stage of development of the plant is the disease more prevalent?

"Is secondary decay of the hearts a common occurrence, or is the disease characterized by dry rot?

"Have you any additional suggestions to make as to cause of blackheart of celery, varietal susceptibility, soil relationship, fertilizer relation, or insects as related to secondary decay?"

The following excerpts from replies to the above questionnaire indicate that celery blackheart appears in all States where the crop is grown commercially.

MAINE: The heart rot which Dr. Folson mentioned was found only once. This was on a medium soil which sloped to the east. There had been some drouth but not at all severe and irrigation had been practised by means of running water from the hose down a small furrow along the row. Maggots were found as Dr. Folson mentioned and the disease appeared to be that described by Leach. (R. M. Riley)

NEW HAMPSHIRE: The disease occurs only in New Hampshire during dry years and in dry soils. Soft rot at times follows blackheart. (O. Butler)

MASSACHUSETTS: Celery blackheart is not what one would call prevalent in any year here. It is common in some seasons, and present in very small amounts in others; but it is not of much commercial importance in the worst years. The disease is more likely to be associated with rainy seasons and with excessive soil moisture. It has been observed, however, during our driest summers.

It is more likely to occur on soils of high water holding capacity; heavy soils; poorly drained soils; regardless of amount of organic matter. The worst case I ever observed was in late celery during a dry season, but on low, poorly drained soil that had not really suffered from lack of water. The entire field attained not more than half-size. The stalks were crooked and short, marked with short horizontal cracks, and the heart of every plant broke down into typical blackheart. Only light soft rot followed until the rows were boarded up. Most of that field was a total loss.

Usually, blackheart does not appear until the crop is past half grown; more usually not until it is about ready for boarding up. It is more common in our late celery than in the early crop which is mostly Golden Plume. It is perhaps worse in the Giant Pascul variety than in other sorts. I have seen instances of blackheart where no soft rot decay set in at all; others where the plants were nearly consumed by it. It seems as if wet weather, or boarding up, are the factors to bring on the soft rot. No insect or fertilizer relations have been

NEW YORK: In reply to your questions blackheart is more or less prevalent in New York in certain seasons and at certain times of the year depending on the weather and other factors. I would say that its appearance is associated with both deficient and excessive soil moisture; that is, fluctuations in the water supply combined with air temperatures seem to favor the disease. It seems to me that it is more prevalent around the edges of otherwise well drained muck areas. I assume these shallow portions of the muck are drier and also higher in nitrates. It is more prevalent of course after the celery gets more than half grown although I have seen it on plants less than 8 inches high. It seems to be worse on plants that are going through a rapid development.

Secondary decay of the hearts while common is not at all usual. I think this depends upon the season and on the rainfall. Two years ago we had considerable blackheart and crack stem and it was associated with a good deal of secondary decay but frequently this is not the case. I feel sure in my own mind that insects play a large part in initiating and spreading the secondary decay. It also seems more than likely from small tests we have made that soils with liberal amounts of nitrates are apt to produce more blackheart. (A. G. Newhall)

NEW JERSEY: Blackheart is very prevalent in New Jersey, in certain fields and in some seasons. It is not serious every year. The disease seems to be associated with certain atmospheric conditions rather than soil conditions. It occurs on both sandy and muck soils. We have made no observations as to its relative abundance on soils with different moisture content. We have observed it on fairly young plants and on others which are almost ready to blanch. It seems to be more prevalent on the more mature plants. I should judge, however, that it occurs at certain seasonal periods rather than at certain stages of plant growth. Affected plants very often collapse with secondary soft rot. The trouble here seems to be somewhat of the nature of lettuce tip burn. This idea is based entirely upon general observation of the two diseases and not upon experimental data. (C. M. Haenseler)

PENNSYLVANIA: I have not seen much of the blackheart disease of celery in this State which has not been associated with a bacterial trouble. I think that there is a little blackheart present, but I am very sorry that I do not have sufficient information on it to answer your question. (R. S. Kirby)

DELAWARE: We have occasionally reported the blackheart disease but in no instance have I observed it of any economic importance. Generally, we have observed it during the blanching stage or when the crop is harvested but have not given it sufficient attention to associate any of the contributing factors. (J. F. Adams)

VIRGINIA: Under certain conditions the disease is apt to become destructive, especially when the seed is planted to mature the plants during June and July. If the plants are allowed to remain in the field after maturity there is apt to be considerable injury from blackheart followed by a

soft rot which destroys the center of the entire plant. In the few cases that we have seen celery growing in muck soil, there has been no evidence of blackheart present. A summation of our experiences with celery shows that high temperatures combined with alternate drying and wetting of the soil, especially after the plants are mature, will have a tendency to cause an outbreak of blackheart. (M. M. Parker)

FLORIDA: The disease has been recognized as being prevalent and destructive in this State for the last thirty years. Its appearance is limited almost entirely to the light sandy soils that are sub-irrigated. The disease is rarely ever found on the muck or peat soils. In this State the disease appears to be more largely influenced by excessive moisture, and the old general practice of raising the water table under celery just before harvest probably accounted for most of the disease. The disease may appear during any stage of the development of the plant but is more common on older plants. Secondary decay is common but typical dry rot is the peculiar characteristic of the disease. Increasing amounts of a balanced fertilizer cause a corresponding increase of the disease when other conditions are favorable. (Foster and Weber)

LOUISIANA: Celery frequently gets soft rot when grown in the heavy soils of south Louisiana, but whether it is preceded by the blackheart disease, I am unable to say. (C. W. Edgerton)

TEXAS: The appearance of celery blackheart in Texas has been largely the reason for the failure to grow celery in the State successfully. (Taubenhaus)

OHIO: Celery blackheart is not prevalent in this State every year, but with certain types of weather conditions during mid-summer, it does appear in some of the marshes. Last year and the year before there was some of the disease, but so far this year, I have not received any report concerning it. Its appearance does seem to be associated with some moisture conditions, and it seems to be brought on by short, severe drouth periods following other periods of good growing conditions. It is much more prevalent on muck lands than on upland soils. The disease is usually noticed just before the plants are ready for boarding, but it seems likely that the stage of its inception must have occurred some two weeks earlier than this. Last year a great deal of the disease was noticeable as a wet rot caused by secondary decay during a period of high temperature and excessive rainfall at the time of boarding. This period had, however, been preceded by much drier weather. There has been some evidence that the disease is worse on plots which have been fertilized heavily with nitrogen. I believe that there is some difference in varietal susceptibility, but I am not sure just which varieties are the most susceptible. However, I do know that some of the green strains are not usually as much affected as some of the self-blanching types.

In a number of cases there have been insects found in connection with the trouble, but whether they have been in any way connected with it, I am not sure. (J. D. Wilson)

ILLINOIS: This disease has not been reported from our State. (H.W.Anderson)

MICHIGAN: This disease has been prevalent in Michigan during the past two seasons but I am sorry that at the present time we can give you no definite information concerning the reaction of varieties on different types of soil, or the association of the disease with excessive or deficient soil moisture. The disease has never caused any considerable damage to celery in Michigan previous to last year. Last season it was very serious in some sections and this year, although not nearly so prevalent, it did cause considerable damage in some fields. (Ray Nelson)

WISCONSIN: The disease has been found in this State in all sections where celery is grown. Its appearance has been confined to muck soils, and the contributing cause appears to be mainly periods of drouth. Increasing amounts of fertilizer influence the appearance of the disease. (Foster)

MINNESOTA: Prevalent in this State but not so common as soft rot. Associated with deficient soil moisture and high temperature. More common on well drained muck lands. Dry rot is characteristic of blackheart but it may be followed by soft rot. (J. G. Leach)

MONTANA: Occasionally occurs but is not prevalent to any amount. (H. E. Morris)

COLORADO: Blackheart has occasionally occurred here in the State. Some Some several years ago we had a bad case in one region. This year we have had another serious attack of it near Denver. Its appearance seems to be associated with excessive irrigation. It appears to be more prevalent on the black muck soils. It develops just before harvest, especially where the plants are tall and rank growing. B. carotovorus seems to be associated with it. I have always thought it was the cause of the disease. Its infrequent occurrence and the small amount of damage, however, has never, in my notion, necessitated special work upon it. I am not able to tell you about the relation of fertilizers, insects, or varietal susceptibility. (L. W. Durrell)

UTAH: Celery blackheart is prevalent in Utah in certain types of soil. There is a small percentage of it every year; and probably about every third to fifth year the celery grown in the heavier soils is rather severely damaged. During these years of epidemic outbreaks certain fields are practically entirely destroyed. The disease appears to be associated with excessive soil moisture. Following periods of drought the celery in Utah is sometimes rather seriously affected with cracking of the petiole and with blackheart. This is especially true if early fall rains are heavy after a late summer drought.

The disease this year, and every year in the past that has been called to my attention, was most prevalent on soils of high water-holding capacity. During the past season the most serious outbreaks of the disease were located on the heavy clay soils southwest of Salt Lake City and west and north of Brigham City. These soils also have a high water table. Last summer was not a hot nor a dry summer judging from the average summer climate of this region. In fact, it was rather wet. The summer before last (1931) was very dry followed by a wet fall. In spite of such a sequence of conditions, very little blackheart was reported.

The disease usually makes its appearance in August or the very early part of September when the plants are about one foot to 18 inches in height. Sometimes the disease does not put in its appearance until the beginning of hilling up. If hilling starts early and a hot dry period follows, trouble with the disease is nearly always experienced. Growers can not get onto the early market with Utah celery because of this difficulty. Rapid respiration induced by the hilling in high temperatures has been suggested as a factor in this expression of the disease. The appearance of the secondary decay of the hearts is very erratic and varying in Utah. When the disease appears in the field before hilling, it is nearly always characterized by a dry rot and a necrosis of the tips of most of the outer leaves as well as the younger leaves. Sometimes soft rot comes in later as a secondary decay. This is by no means always the case. When it follows early hilling it begins as a typical dry rot but soon develops the soft rot characteristics. A condition of high humidity is set up around the crown of the plant which is extremely favorable for the development of soft rot.

I have never observed any conditions which even approximate the set of conditions which Dr. Leach describes in his article in Phytopathology as conducive to the disease. While I have no definite theory to account for the appearance of blackheart, it seems to be associated with the misapplication of irrigation water in the great majority of cases investigated. Irrigation water applied in excess so that the water table is raised unduly or in such a manner as to induce scalding of the celery plant seems to favor the development of the disease. (H. L. Blood)

IDAHO: Although I would not say that this disease is entirely absent in our celery-growing areas, it has not become important enough to be called to our attention except in a very few minor cases. (C. W. Hungerford)

OREGON: The blackheart disease of celery is certainly not common or serious in Oregon, as far as we can judge by the failure of growers to call our attention to such a condition. Perhaps some of the soft rot which has been reported now and then as coming when celery is at least half or two-thirds grown, may be associated with this blackheart condition, but observations have not

been conducted on a close enough basis by any plant pathologist to enable us to say whether that is actually true or not. (H. P. Barss)

CALIFORNIA: The disease occurs in the State during certain seasons but we have not correlated its appearance with any particular climatic condition and I am not in a position to say that the appearance of the disease is in any way associated with a deficiency or excess of soil moisture. More complete observations might answer this question. When the disease has occurred, it has been on muck land as most of our celery is grown in peat soils. I have no information as to the stage of development of the plant in which the disease is more prevalent. Secondary decay of the hearts is a common occurrence. (J. B. Kendrick)

Most of the celery in San Diego County is grown in the two adjacent towns of Otay and Chula Vista. The town of Chula Vista is supplied with irrigation water from a mountain reservoir under good pressure, and Otay obtains all irrigation water from wells on individual farms, usually with pumping plants of very limited capacity. During December, January, and February blackheart was very prevalent in nearly all Otay fields, although the weather was cool and favorable for healthy growth. During the same months there was practically no blackheart in Chula Vista fields. Some growers thought the larger amounts of alkali salts in the Otay water might be responsible, as blackheart seemed to develop whenever rains failed and it became necessary to irrigate. It has, however, seemed to me more likely that the method of applying the water is responsible for the difference in prevalence of the disease in the two towns. In both irrigation is by means of running water down open furrows between the rows. With the good supply of water at Chula Vista a field can usually be irrigated in about 48 hours. The small capacity pumping plants at Otay are hard pressed in many cases to keep the celery supplied with water, which was particularly true this season, when there was very little rain. Consequently several days are often required to irrigate a field, and a large part of the field may remain more or less water-logged for several days before the water reaches the far ends of the furrow. (I. C. Jagger, 1924)

CANADA: Celery blackheart is prevalent in many sections of this Province and in certain seasons causes very considerable loss to our growers It is usually most abundant in dry seasons in fields where irrigation is not practiced. It appears to be more prevalent in soils of low water holding capacity, but is not prevalent to the same extent on well drained muck lands. Blackheart is usually most prevalent just before celery reaches maturity. Secondary decay of the hearts is a common occurrence. In many cases it appears to be due to Bacillus carotovorus. (J. E. Howitt, Guelph)

I observed blackheart of celery occasionally during the last four or five years. In 1930, I came across a field in the Montreal

district that was badly affected, about 25 to 30 per cent of the plants being diseased. That was my only observation of this disease that year. In 1931, it was very prevalent in the Montreal district. One field in particular, where celery was growing in light sandy loam, Cote des Neiges, 5- per cent of the celery was affected. In the other fields observed where the disease was present, it ranged from a trace to about 10 per cent. It did not occur on celery growing in black muck soil. (H. N. Racicot)

We have had this disease under observation for over two years now, and are still undecided as to whether it may be purely a physiological trouble or not. There seems to be no evidence whatever that excessive soil moisture has anything to do with the disease under our conditions. At least we have been unable to produce the disease by flooding as has been reported in Florida by Foster. Nor is the disease as found in the field associated with excessive moisture. Personally, I am much more inclined to think that lack of soil moisture accompanied by excessive transpiration is more likely the cause, though again, we have not any definite evidence to support this contention. (G. H. Berkeley)

It is an unusual and noteworthy condition for a non-parasitic or physiological disease like celery blackheart, that is apparently caused primarily by unfavorable environmental conditions such as widely fluctuating soil moisture and excessive fertilizer, to be so widely distributed and prevalent in all sections where celery is grown on a commercial scale. The reaction of the celery plant to the conditions that cause the disease is by no means a simple one, on the contrary, it is perhaps as complicated as any problem in plant physiology. One of the most perplexing conditions associated with the disease is that it appears to be induced by excessive soil moisture in many cases and by drouth in many others. Plants that are highly fertilized and succulent are more susceptible.

The disease was held under control in Florida for four years by the use of moderate amounts of fertilizer and careful regulation of the soil moisture.

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SCLEROTIUM ROLFSII ON APPLE TREES IN VIRGINIA

On October 11 T. W. Turner wrote that Sclerotium rolfsii had caused the death of three young apple trees on the Whipple Farm of Hampton Institute in Virginia. Later (Nov. 20) he added that cultures made from one of the dead trees showed typical growth and sclerotia of S. rolfsii. The apple, judging from the scarcity of reports, is apparently a rather unusual host for this fungus.